the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. specifically binding to antibodies generated against SEQ ID NOS:30 or 42.

57. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and;

iii. selectively hybridizes to a sequence selected from the group consisting of SEQ ID NOS:13, 14, 15, 16, 21, 22, 44, and 48, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 40% formamide, 1 M NaCl and 1% SDS, and washed at 55°C in a solution comprising 0.5x SSC.

58. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. comprising an amino acid sequence having at least 60% identity to a core region of a protein selected from the group consisting of: amino acids 124 to 451 of SEQ ID NO:1, amino acids 135 to 462 of SEQ ID NO:2, amino acids 109 to 436 of SEQ ID NO:3, amino acids 23 to 351 of SEQ ID NO:4, amino acids 134 to 461 of SEQ ID NO:19, amino acids 109 to 436 of SEQ ID NO:20, amino acids 288 to 615 of SEQ ID NO:43, and amino acids 238 to 465 of SEQ ID NO:47.

59. The nucleic acid of claim 58, encoding a monomer comprising an amino acid sequence having at least 85% identity to said core region.

60. The isolated nucleic acid of claim 56, 57, or 58, wherein said nucleic acid encodes a protein having an amino acid sequence selected from the group consisting of SEQ ID NO:1, SEQ ID NO:2, SEQ ID NO:3, SEQ ID NO:4, SEQ ID NO:19, SEQ ID NO:20, SEQ ID NO:43, and SEQ ID NO:47.

61. The isolated nucleic acid of claim 56, 57, or 58, said nucleic acid having a nucleotide sequence selected from the group consisting of: SEQ ID NO:13, SEQ ID NO:14, SEQ ID NO:15, SEQ ID NO:16, SEQ ID NO:21, SEQ ID NO:22, SEQ ID NO:44, and SEQ ID NO:48.

62. The isolated nucleic acid of claim 56, 57, or 58, the nucleic acid encoding a monomer that forms a homomeric potassium channel.

63. An expression vector comprising a nucleic acid of claim 56, 57, or 58.

64. A host cell transfected with the vector of claim 63.

65. A method of making a calcium-activated potassium channel protein, comprising culturing the host cell of claim 64 under conditions permitting expression of said nucleic acid encoding said channel protein.

66. A method for detecting the presence, in a biological sample, of a nucleic acid sequence encoding a calcium-activated potassium channel protein, said method comprising:

(a) contacting said sample with a nucleic acid probe comprising a nucleic acid segment that selectively hybridizes to a nucleic acid having a sequence selected from the group consisting of SEQ ID NO:13, SEQ ID NO:14, SEQ ID NO:15, SEQ ID NO:16, SEQ ID NO:21, SEQ ID NO:22, SEQ ID NO:44, and SEQ ID NO:48, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 50% formamide, 1 M NaCl

and 1% SDS, and washed at 60°C in a solution comprising 0.1x SSC; and

(b) allowing said nucleic acid encoding the channel protein to selectively hybridize to said probe to form a hybridization complex, wherein detection of said hybridization complex is an indication of the presence of said nucleic acid sequence in said sample.

67. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. specifically binding to antibodies generated against SEQ ID NOS:1 or 4.

68. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

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i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and;

iii. selectively hybridizes to a sequence selected from the group consisting of SEQ ID NOS:13 and 14, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 40% formamide, 1 M NaCl and 1% SDS, and washed at 55°C in a solution comprising 0.5x SSC.

69. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. comprising an amino acid sequence having at least 60% identity to a core region of a protein selected from the group consisting of: amino acids 124 to 451 of SEQ ID NO:1 and amino acids 23 to 351 of SEQ ID NO:4.

70. The nucleic acid of claim 69, encoding a monomer comprising an amino acid sequence having at least 85% identity to said core region.

71. The isolated nucleic acid of claim 67, 68, or 69, wherein said nucleic acid encodes a protein having an amino acid sequence selected from the group consisting of SEQ ID NO:1 and SEQ ID NO:4.

72. The isolated nucleic acid of claim 67, 68, or 69, said nucleic acid having a nucleotide sequence selected from the group consisting of: SEQ ID NO:13 and SEQ ID NO:14.

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73. The isolated nucleic acid of claim 67, 68, or 69, the nucleic acid encoding a monomer that forms a homomeric potassium channel.

74. An expression vector comprising a nucleic acid of claim 67, 68, or 69.

75. A host cell transfected with the vector of claim 74.

76. A method of making a calcium-activated potassium channel protein, comprising culturing the host cell of claim 75 under conditions permitting expression of said nucleic acid encoding said channel protein.

77. A method for detecting the presence, in a biological sample, of a nucleic acid sequence encoding a calcium-activated potassium channel protein, said method comprising:

(a) contacting said sample with a nucleic acid probe comprising a nucleic acid segment that selectively hybridizes to a nucleic acid having a sequence selected from the group consisting of SEQ ID NO:13 and SEQ ID NO:14, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 50% formamide, 1 M NaCl and 1% SDS, and washed at 60°C in a solution comprising 0.1x SSC; and

(b) allowing said nucleic acid encoding the channel protein to selectively hybridize to said probe to form a hybridization complex, wherein detection of said hybridization complex is an indication of the presence of said nucleic acid sequence in said sample.

78. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. specifically binding to antibodies generated against SEQ ID NOS:2 or 19.

79. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and;

iii. selectively hybridizes to a sequence selected from the group consisting of SEQ ID NOS:15 and 21, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 40% formamide, 1 M NaCl and 1% SDS, and washed at 55°C in a

solution comprising 0.5x SSC.

80. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. comprising an amino acid sequence having at least 60% identity to a core region of a protein selected from the group consisting of: amino acids 135 to 462 of SEQ ID NO:2 and amino acids 134 to 461 of SEQ ID NO:19.

81. The nucleic acid of claim 80, encoding a monomer comprising an amino acid sequence having at least 85% identity to said core region.

82. The isolated nucleic acid of claim 78, 79, or 80, wherein said nucleic acid encodes a protein having an amino acid sequence selected from the group consisting of SEQ ID NO:2 and SEQ ID NO:19.

83. The isolated nucleic acid of claim 78, 79, or 80, said nucleic acid having a nucleotide sequence selected from the group consisting of: SEQ ID NO:15 and SEQ ID NO:21.

84. The isolated nucleic acid of claim 78, 79, or 80, the nucleic acid encoding a monomer that forms a homomeric potassium channel.

85. An expression vector comprising a nucleic acid of claim 78, 79, or 80.

86. A host cell transfected with the vector of claim 85.

87. A method of making a calcium-activated potassium channel protein, comprising culturing the host cell of claim 86 under conditions permitting expression of said nucleic acid encoding said channel protein.

88. A method for detecting the presence, in a biological sample, of a nucleic acid sequence encoding a calcium-activated potassium channel protein, said method comprising:

(a) contacting said sample with a nucleic acid probe comprising a nucleic acid segment that selectively hybridizes to a nucleic acid having a sequence selected from the group consisting of SEQ ID NO:15 and SEQ ID NO:21, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 50% formamide, 1 M NaCl and 1% SDS, and washed at 60°C in a solution comprising 0.1x SSC; and

(b) allowing said nucleic acid encoding the channel protein to selectively hybridize to said probe to form a hybridization complex, wherein detection of said hybridization complex is an indication of the presence of said nucleic acid sequence in said sample.

89. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. specifically binding to antibodies generated against SEQ ID NOS:3, 20, 43, or 47.

B1 Cont.

90. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in

the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and;

iii. selectively hybridizes to a sequence selected from the group consisting of SEQ ID NOS:16, 22, 44 and 48, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 40% formamide, 1 M NaCl and 1% SDS, and washed at 55°C in a solution comprising 0.5x SSC.

91. An isolated nucleic acid encoding a monomer of a calcium-activated potassium channel, said monomer:

i. having a calculated molecular weight of between 40 and 80 kDa;

ii. having a unit conductance of between 2 and 60 pS when the monomer is in the functional polymeric form of a potassium channel and is expressed in a *Xenopus* oocyte; and

iii. comprising an amino acid sequence having at least 60% identity to a core region of a protein selected from the group consisting of: amino acids 109 to 436 of SEQ ID NO:3, amino acids 109 to 436 of SEQ ID NO:20, amino acids 288 to 615 of SEQ ID NO:43, and amino acids 238 to 465 of SEQ ID NO:47.

92. The nucleic acid of claim 91, encoding a monomer comprising an amino acid sequence having at least 85% identity to said core region.

93. The isolated nucleic acid of claim 89, 90, or 91, wherein said nucleic acid encodes a protein having an amino acid sequence selected from the group consisting of SEQ ID NO:3, SEQ ID NO:20, SEQ ID NO:43 and SEQ ID NO:47.

94. The isolated nucleic acid of claim 89, 90, or 91, said nucleic acid having a nucleotide sequence selected from the group consisting of: SEQ ID NO:16, SEQ ID NO:22, SEQ ID NO:44 and SEQ ID NO:48.

95. The isolated nucleic acid of claim 89, 90, or 91, the nucleic acid encoding a monomer that forms a homomeric potassium channel.

96. An expression vector comprising a nucleic acid of claim 89, 90, or 91.

97. A host cell transfected with the vector of claim 96.

98. A method of making a calcium-activated potassium channel protein, comprising culturing the host cell of claim 97 under conditions permitting expression of said nucleic acid encoding said channel protein.

99. A method for detecting the presence, in a biological sample, of a nucleic acid sequence encoding a calcium-activated potassium channel protein, said method comprising:

(a) contacting said sample with a nucleic acid probe comprising a nucleic acid segment that selectively hybridizes to a nucleic acid having a sequence selected from the group consisting of SEQ ID NO:16, SEQ ID NO:22, SEQ ID NO:44 and SEQ ID NO:48, wherein the hybridization reaction is incubated overnight at 37°C in a solution comprising 50% formamide, 1 M NaCl and 1% SDS, and washed at 60°C in a solution comprising 0.1x SSC; and

(b) allowing said nucleic acid encoding the channel protein to selectively hybridize to said probe to form a hybridization complex, wherein detection of said hybridization complex is an indication of the presence of said nucleic acid sequence in said sample.

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REMARKS

The invention

In one aspect, the present application provides, for the first time, identification of a family of calcium-activated potassium channels. This family is called the "SK" family, for small conductance potassium channels. This family of channels is highly conserved (about